RunIEC User's Guide
by

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Introduction

When generating a loads document for a wind turbine, one usually needs to run all the International Electrotechnical Commission (IEC) design load cases. This can be a daunting task and doing it one case at a time may lead to errors and inconsistencies.

To make this task a little easier, I have created two Perl scripts to automate it for you. One of them, RunIEC, runs all the discrete wind events generated by IECWind and WindMaker. Its companion, RunNTM, runs a series of normal-turbulence-model simulations. This user's guide will address use of the former.

I originally wrote these scripts to help someone run these cases for a specific turbine, which had proprietary properties. I have converted the scripts to use my AWT-27CR FAST_AD model as an example. You will need to create your own FAST_AD model to replace mine.

In case you do not know much about Perl, it is an interpreted scripting language with many powerful features. For those folks who have struggled to get DOS batch files to do useful things, Perl is an excellent replacement. As with DOS batch files, you initiate Perl scripts at a command prompt.

I first came across Perl when setting up our web pages. Perl is commonly used to do many of the intelligent things web pages do. It is available for many platforms and it is not very difficult to learn. That makes it an excellent choice to automate many of our boring, routine tasks.

Retrieving Files from the Archive

You should download the RunIEC archive from our web server page http://wind2.nrel.gov/designcodes/runiec/. The file should have a name such as "runiec_v200.exe." Create a RunIEC folder somewhere on your file system and put this file there. You can double-click on it from Windows Explorer or by entering "runiec_v200" at a command prompt with the RunIEC folder as the current directory. This will create some files and folders.

Distributed Files

The files included in the archive of RunIEC are as follows:

ArcFiles.txt	The list of files that are written to the archive
Archive.bat	The batch file that creates the archive
ChangeLog.txt	The list of changes to the RunIEC Perl script
RunIEC	The Perl script
RunIEC.cru	The Crunch input file used to find the extreme events
RunIEC.doc	This user's guide in Word format
RunIEC.fad	The FAST_AD model of the AWT-27CR turbine
RunIEC.pdf	This user's guide in PDF format
AeroData*.dat	The airfoil data files for the AWT-27CR
Wind\IEC.IPT	The IECWind input file

Installing Associated Software

Before using RunIEC, you must first create the wind files for AeroDyn. You need a copy of the IECWind program to do this. You can get it off our web page at http://wind2.nrel.gov/designcodes/iecwind/. You should install IECWind on your computer is such a way that it can be executed from any folder on your system. Once you have done that, open a command prompt in the Wind folder created when you retrieved the files from the archive and enter "iecwind". IECWind will generate 25 files with a "wnd" extension.

If you have not already done so, you need to install FAST_AD, Crunch, and a Perl interpreter. You can get FAST_AD and Crunch off our web site at http://wind2.nrel.gov/designcodes/. You should install them so that they can run from any folder, but you can specify their locations in the Perl script. You can

download a freeware Perl interpreter from ActiveState at http://www.activestate.com/. You should also install it so that it can be run from any folder. The examples below assume that you can invoke the Perl interpreter by entering "perl" at a command prompt. If you use another name, substitute it into the example below.

Modifying the Perl Script

You need to modify the Perl script before you can run it on your PC. Edit the file named "RunIEC" with your favorite editor, and search for the string "USER" with a case-sensitive search. You will most certainly need to change the variables $fast_ad and $crunch. Set them so they point to the FAST_AD and Crunch executables you installed earlier.

If you decide to put your wind files in a folder other than the Wind folder that the archive installed on your PC, you will have to change the $wind_loc variable too. If you do not want Crunch to run after all the simulations have run, comment out the Crunch execution statement by putting a pound sign ("#") at the beginning of the line.

If you choose to use a different simulator than FAST_AD, you will need to make many more changes to the script. To do that, you will need to know more about Perl. I learned Perl by stealing other people's code and modifying it to suit my needs. Fortunately, I had George Scott to help me learn the language, but anyone with basic programming skills can master it. George recommended two books (*Programming Perl*, by Larry Wall, et al. and *Effective Perl Programming*, by Joseph Hall and Randal Schwartz) to help me learn the language. I use the first the most. Modifying the script for another simulator will be simulator dependent, so I will not attempt to explain how to do it here. Looking for the strings "fast_ad" and "fastad" will give you an idea where to start.

Running RunIEC

Before using RunIEC, please check the versions of FAST_AD and Crunch you have installed on your computer. If they are newer than your RunIEC archive, you may have to make changes to their input files to bring them up to the current versions. The input files supplied with RunIEC (RunIEC.fad and RunIEC.cru) mention which versions of the programs they are compatible with at the tops of the files.

To test the script, you can use my AWT-27CR model. Try that first before using your own model with RunIEC. Open up a command window in the main RunIEC folder. Enter "perl runiec" at the command prompt. The script will copy each wind file and run FAST_AD with it as input to the simulator. It will

do this 25 times. It takes about 12 minutes to do this on my 600-MHz PC. It generates files with the root name of the IEC wind file and with the extensions "tim" and "sum." These are the time-series results and the FAST_AD summary files.

After the simulations, it will run Crunch and generate the aggregate statistics and the extreme events of all 25 cases. These results go into the files "aggregate.sts" and "aggregate.eev."

The Crunch run generates load roses of the blade-root loads and the tower-top loads. It will group the channels for the two roses in two extreme-event tables, which can be used to document the extreme events that occurred in all the runs.

After you have run the script with the original model, you will need to change the Crunch, FAST_AD, and IECWind input files to represent your turbine. You will also need to rerun IECWind to generate wind files for your turbine. To do that, edit "IEC.IPT," which is found in the Wind folder. The FAST_AD and Crunch input files are found in the main RunIEC folder and are called "RunIEC.fad" and "RunIEC.cru." If you change the output variables in the FAST_AD input file, you will need to modify the Crunch input file to change which channels are analyzed. You may also want make other changes to the Crunch input file to suit your analysis needs. After you have done all these things, you can rerun the script.

For a real loads document, you should also include other events—especially the normal-turbulence cases and the various fault conditions. You would then want to do one Crunch run with all those simulations as input. To help you with that, you can use the companion script, RunNTM to generate the normal-turbulence runs. For the fault conditions, you are on your own. If you do this, it will probably make sense to comment out the Crunch call in the Perl script and then run Crunch manually after the script runs all the cases. Look for the string "USER" to find the line that you need to disable in the Perl script.

Known Bugs

- None.

Caveats

The National Renewable Energy Laboratory (NREL) makes no promises about the usability or accuracy of RunIEC, which is essentially a beta code. NREL does not have the resources to provide full support for this program. *You may use RunIEC for evaluation purposes only*.

Acknowledgements

Feedback

If you have problems with RunIEC, please contact Marshall Buhl. If he has time to respond to your needs, he will do so, but please do not expect an immediate response. Please send your comments or bug reports to:

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